NOTES FROM PACIFIC COAST OBSERVATORIES.

Polarization Phenomena of Coelostat Telescopes.

In the investigation of solar magnetism, it is necessary to take into account the polarization effects produced by the reflection of the light, before entering the spectrograph, on the silvered surfaces of the mirrors of the coelostat telescope employed. In the case of the 60-foot and 150-foot tower telescopes of the Mount Wilson Solar Observatory the sunlight is twice reflected—first by the coelostat mirror and subsequently by the second mirror, which sends it vertically downward to an objective of 60 feet or 150 feet focal length. In general, a line which is single in the spectrum of any light-source is resolved into two components when the light-source is placed in a magnetic field and the observation is made in the direction of the lines of force. The light of each component is circularly polarized, right-handedly in one case and left-handedly in the other. When circularly polarized light falls upon a silvered surface it is transformed into elliptically polarized light. In the case of the components of a magnetic doublet in the spectrum of a sun-spot, the direction of the major axis, as well as the eccentricity of the ellipse, depend upon the position of the tower telescope mirrors. As these change with the declination of the Sun and the hour of the day, it is essential that a careful study of the polarization phenomena be made for all the positions in which the Sun may be observed.

To accomplish this a small model of the tower telescope has been constructed in the observatory instrument shop. At the upper end of the polar axis of the model coelostat an adjustable arc, carrying a small incandescent lamp, is attached. By varying the length of the arc the incandescent lamp can be made to coincide in direction with the Sun at any declination. Thus

rotation of the polar axis will cause the incandescent lamp to move through a path corresponding to the path of the Sun in the heavens, for the date in question. The light of the incandescent lamp, rendered parallel by a collimating lens, falls upon a Nicol prism and subsequently upon a quarter-wave plate, set so that its principal section makes an angle of 45° with the short axis of the Nicol. By setting the principal section to the left or right, right-handed or left-handed circularly polarized light can be produced at will. After falling upon the coelostat mirror the light is reflected to the second mirror and then to a small telescope, over the object-glass of which is mounted a quarter-wave plate and a Nicol prism. After the instrument has been set for the proper declination and hour angle, it is then only necessary to turn the quarter-wave plate and the Nicol prism on the observing telescope until the light of the incandescent lamp is completely extinguished. The position of the principal section of the quarter-wave plate and the major axis of the ellipse, as given by a divided circle, furnish the data required for actual observation of sun-spot lines. It should be added that since the quarter-wave plate is corrected for a particular wave-length, it is necessary to place a piece of colored glass over the incandescent lamp in order to secure complete extinction. From a series of observations made by Miss BURWELL and myself a table is being prepared giving the proper settings of the quarter-wave plate and the Nicol prism for all declinations and hour-angles of the Sun. The phenomena observed when the incident light is plane or elliptically polarized (as in the case of sun-spot lines observed across the lines of force), and the influence on the results of tarnished mirrors, are also under investigation.

The polarizing apparatus constructed for the new 75-foot spectrograph of the 150-foot tower telescope consists of a Nicol prism five inches in length, above which can be mounted quarter-wave or half-wave plates especially suited for the investigation in hand. As the Nicol prism is designed for use with a long slit and cannot be rotated, it is necessary to provide means of rotating the plane of polarization of the light after transmission through the quarter-wave plate. This is accomplished by means of a half-wave plate, mounted between the quarter-wave plate and the Nicol prism, and adjusted to any position

angle. For the observation of weak magnetic fields in regions remote from sun-spots a compound quarter-wave plate, consisting of strips two millimeters in width, set so that the principal sections of adjoining strips make an angle of 90° with one another, is employed. For other investigations, especially of sun-spot spectra, a circular quarter-wave plate, divided through the center and consisting of two parts whose principal sections are at right angles, is used. For the study of plane polarization phenomena, half-wave plates, similarly divided into two parts, are also supplied.

As the position angle at which these various plates must be set depends not merely upon the Sun's declination and the hour of the day, but also upon the position angle of the spectrograph slit, it is desirable that the polarizating apparatus be so arranged that it can be tested in conjunction with the polarimeter, set for the proper declination and hour angle of the Sun. In this way all of the adjustments of the polarizing apparatus can be made and tested in advance or, in case it is desired to determine exactly what the polarization phenomena were at the date of some given observation, these can be reproduced and observed. The entire apparatus, including the polarimeter, can also be set up in conjunction with the 75-foot spectrograph, for the study of the polarizing effect of the grating. GEORGE E. HALE.

THE MAGNITUDE EQUATION AND ZENITH CORRECTION IN MERIDIAN CIRCLE OBSERVATIONS.—The determination of the above corrections has recently been repeated with the Repsold meridian circle of the Lick Observatory. Following the fifteen years of observing with this instrument, two years' work was done with the Pistor & Martin's 8-inch meridian circle of the Dudley Observatory, used for the San Luis Observatory of the Carnegie Institution. Some change in personal equation might be expected, with the use of another instrument, under conditions of observing that were different in many particulars. The values determined, both before and after the observations at San Luis, are tabulated here, for comparison with the approximate values which have been taken out for the southern observatory.